

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An optical memory reproduction apparatus which reproduces data from an optical memory medium $[(2)]$ comprising: cores $[(21)]$ each of which constitutes a planar optical waveguide, and clads $[(22)]$ which sandwich each core $[(21)]$, and having: a data image $[(203)]$ in which data is recorded as a scattering factor; and a pair of positioning marks $[(201, 202)]$ which are respectively scattering factors required for positioning, at an interface between a core $[(21)]$ and a clad $[(22)]$ or in the core $[(21)]$,

the optical memory reproduction apparatus comprising:

a light source $[(11)]$ which emits: a read light $[(103)]$ which is caused to enter the core $[(21)]$ from an end surface of the optical memory medium $[(2)]$, travels while spreading in the core $[(21)]$, and is coupled with the core $[(21)]$ to form an optical coupling area in such a manner that the optical coupling area includes the data image $[(203)]$; and a pair of positioning lights $[(101, 102)]$ which are caused to enter the core $[(21)]$ with offsets with respect to the read light $[(103)]$ in opposite directions along a thickness direction of the core $[(21)]$, travels in the core $[(21)]$, and are coupled with the core $[(21)]$ to form optical coupling areas in such a manner that the optical coupling areas include the pair of positioning marks $[(201, 202)]$;

a data reproduction light imaging element $[(133)]$ which receives a data reproduction light $[(1031)]$ generated due to scattering and interference of the read light $[(103)]$ in the data image $[(203)]$;

a data reproducing unit $[(14)]$ which reproduces data imaged by the data reproduction light imaging element $[(133)]$;

a positioning mark light receiving element $[(131, 132)]$ which receives a pair of positioning mark lights $[(1011, 1021)]$ generated due to scattering and interference of the pair of positioning lights $[(101, 102)]$ in the pair of positioning marks $[(201, 202)]$; and

a light source position control unit [(16)] which controls an incidence position of the read light [(103)] with respect to the core [(21)] in the thickness direction thereof based on intensities of the pair of positioning mark lights [(101, 102)] detected by the positioning mark light receiving element [(131, 132)].

2. (Currently Amended) The optical memory reproduction apparatus according to claim 1, wherein a condensing pattern of each positioning light [(101, 102)] is a dot-like shape or a circular shape.

3. (Currently Amended) The optical memory reproduction apparatus according to claim 1, wherein the light source [(11)] alternately emits the pair of positioning lights [(101, 102)] in a time-sharing manner.

4. (Currently Amended) An optical memory reproduction apparatus which reproduces data from an optical memory medium [(2)] comprising: cores [(21)] each of which constitutes a planar optical waveguide; and clads [(22)] which sandwich each core [(21)], and having: a pair of data images [(201, 202)] in which the data is recorded as a scattering factor; and a pair of positioning marks [(201, 202)] which are respectively scattering factors required for positioning, at an interface between a core [(21)] and a clad [(22)] or in the core [(21)],

the optical memory reproduction apparatus comprising:

a light source [(11)] which emits a pair of positioning/read lights [(101, 102)] which are caused to enter the core [(21)] from an end surface of the optical memory medium [(2)] at different positions in a thickness direction of the core [(21)], travel while spreading in the core [(21)], and are coupled with the core [(21)] to form optical coupling areas in such a manner that the optical coupling areas respectively include the pair of data images [(201, 202)] and the pair of positioning marks [(201, 202)];

a data reproduction light imaging element [(133)] which receives a pair of data reproduction lights [(1012, 1022)] generated due to scattering and interference of the pair of positioning/read lights [(101, 102)] in the pair of data images [(2011, 2012)];

a data reproducing unit [(14)] which reproduces data imaged by the data reproduction light imaging element [(133)];

a positioning mark light receiving element [(131, 132)] which receives a pair of positioning mark lights [(1011, 1021)] generated due to scattering and interference of the pair of positioning/read lights [(101, 102)] in the pair of positioning marks [(201, 202)];
and

a light source position control unit [(16)] which controls incidence positions of the pair of positioning/read lights [(101, 102)] with respect to the core [(21)] in the thickness direction thereof based on intensities of the pair of positioning mark lights [(1011, 1021)] detected by the positioning mark light receiving element [(131, 132)].

5. (Currently Amended) The optical memory reproduction apparatus according to claim 4, wherein a condensing pattern of each positioning/read light [(101, 102)] is a dot-like shape or a circular shape.

6. (Currently Amended) The optical memory reproduction apparatus according to claim 4, wherein the light source [(11)] alternately emits the pair of positioning/read lights [(101, 102)] in a time-sharing manner.

7. (Currently Amended) An optical memory reproduction apparatus which reproduces data from an optical memory medium [(2)] comprising: cores [(21)] each of which constitutes a planar optical waveguide; and clads [(22)] which sandwich each core [(21)], and having: a data image [(203)] in which data is recorded as a scattering factor; and a pair of positioning marks [(201, 202)] which are respectively scattering factors required for positioning, at an interface between a core [(21)] and a clad [(22)] or in the core [(21)],
the optical memory reproduction apparatus comprising:

a light source [(11)] which emits a positioning/read light [(104)] which has a elliptic or rectangular cross section, is caused to enter the core [(21)] from an end surface of the optical memory medium [(2)] at an angle by which a longitudinal direction of the cross section is not parallel with the interface, travels while spreading in the core [(21)], and is coupled with the core [(21)] to form an optical coupling area in such a manner that a central portion of the optical coupling area includes the data image [(203)] and both end portions of the optical coupling area includes the pair of positioning marks [(201, 202)];

a data reproduction light imaging element [(133)] which receives a data reproduction light [(1031)] generated due to scattering and interference of the positioning/read light [(104)] in the data image [(203)];

a data reproducing unit [(14)] which reproduces data imaged by the data reproduction light imaging element [(133)];

a positioning mark light receiving element [(131, 132)] which receives a pair of positioning mark lights [(1011, 1021)] generated due to scattering and interference of the positioning/read light [(104)] in the pair of positioning marks [(201, 202)]; and

a light source position control unit [(16)] which controls an incidence position of the positioning/read light [(104)] with respect to the core [(21)] in a thickness direction thereof based on intensities of the pair of positioning mark lights [(1011, 1021)] detected by the positioning mark light receiving element [(131, 132)].

8. (Currently Amended) The optical memory reproduction apparatus according to claim 1, claim 4 or claim 7, wherein the light source position control unit [(16)] compares the intensities of the pair of positioning mark lights [(1011, 1021)] with each other, determines a movement direction of the light emitted from the light source [(11)] and moves the light in accordance with a result of the comparison, and controls the incidence position of the light emitted from the light source [(11)] in such a manner that an intensity difference becomes zero.

9. (Currently Amended) An incidence positioning method for a read light [(103)] in an optical memory reproduction apparatus applying the read light [(103)] which travels while spreading to a core [(21)] portion on an end surface of an optical memory medium [(2)] comprising cores [(21)] each of which constitutes a planar optical waveguide and clads [(22)] which sandwich each core [(21)] and having a data image [(203)] in which data is recorded as a scattering factor and a pair of positioning marks [(201, 202)] which are respectively scattering factors required for positioning, at an interface between a core [(21)] and a clad [(22)] or in the core [(21)], the read light [(103)] being coupled with the core [(21)] to form an optical coupling area in such a manner that the optical coupling area includes the data image [(203)], the optical memory reproduction apparatus reproducing data based on a data reproduction light [(1031)] generated due to scattering and interference of the read light in the data image [(203)],

the incidence positioning method comprising:

causing a pair of positioning lights [(101, 102)] to enter the end surface of the optical memory medium [(2)] in such a manner that the pair of positioning lights have offsets with respect to the read light [(103)] in opposite directions along a thickness direction of the core [(21)];

forming an optical coupling area by coupling of the pair of positioning lights [(101, 102)] which have entered the core [(21)] with the core [(21)] in such a manner that the optical coupling area includes the pair of positioning marks [(201, 202)];

receiving by a positioning mark light receiving element [(131, 132)] a pair of positioning mark lights [(1011, 1021)] generated due to scattering and interference of the pair of positioning lights [(101, 102)] in the pair of positioning marks [(201, 202)]; and

controlling an incidence position of the read light [(103)] emitted from the light source [(11)] with respect to the core [(21)] in a thickness direction thereof based on intensities of the pair of positioning mark lights [(1011, 1021)] which have entered the positioning mark light receiving element [(131, 132)].

10. (Currently Amended) The incidence positioning method according to claim 9, wherein a condensing pattern of each positioning light $[(101, 102)]$ is a dot-like shape or a circular shape.

11. (Currently Amended) The incidence positioning method according to claim 9, wherein the pair of positioning lights $[(101, 102)]$ are alternately emitted in a time-sharing manner.

12. (Currently Amended) An incidence positioning method for a pair of positioning/read lights $[(101, 102)]$ in an optical memory reproduction apparatus applying the pair of positioning/read lights $[(101, 102)]$ which travel while spreading to a core $[(21)]$ portion on an end surface of an optical memory medium $[(2)]$ comprising cores $[(21)]$ each of which constitutes a planar optical waveguide and clads $[(22)]$ which sandwich each core $[(21)]$ and having a pair of data images $[(2011, 2012)]$ in which data is recorded as a scattering factor and a pair of positioning marks $[(201, 202)]$ which are respectively scattering factors required for positioning, at an interface between a core $[(21)]$ and a clad $[(22)]$ or in the core $[(21)]$, the pair of positioning/read lights $[(101, 102)]$ being coupled with the core $[(21)]$ to form optical coupling areas in such a manner that the optical coupling areas include the pair of data images $[(2011, 2012)]$, the optical memory reproduction apparatus reproducing data based on a pair of data reproduction lights $[(1012, 1022)]$ generated due to scattering and interference of the pair of positioning/read lights in the pair of data images $[(2011, 2012)]$,

the incidence positioning method comprising:

forming optical coupling areas by coupling the pair of positioning/read lights $[(101, 102)]$ which have entered the core $[(21)]$ with the core $[(21)]$ in such a manner that the optical coupling areas include the pair of positioning marks $[(201, 202)]$;

receiving by positioning mark light receiving element $[(131, 132)]$ a pair of positioning mark lights $[(1011, 1021)]$ generated by scattering and interference of the pair of positioning/read lights $[(101, 102)]$ in the pair of positioning marks $[(201, 202)]$; and

controlling incidence positions of the pair of positioning/read lights $[(101, 102)]$ emitted from the light source $[(11)]$ with respect to the core $[(21)]$ in a thickness direction thereof based on intensities of the pair of positioning mark lights $[(1011, 1021)]$ which have entered the positioning mark light receiving element $[(131, 132)]$.

13. (Currently Amended) The incidence positioning method according to claim 12, wherein a condensing pattern of each positioning/read light $[(101, 102)]$ is a dot-like shape or a circular shape.

14. (Currently Amended) The incidence positioning method according to claim 12, wherein the pair of positioning/read lights $[(101, 102)]$ are alternately emitted in a time-sharing manner.

15. (Currently Amended) An incidence positioning method for a positioning/read light $[(104)]$ in an optical memory reproduction apparatus applying the positioning/read light $[(104)]$ which has an elliptic or rectangular cross section and travels while spreading to a core $[(21)]$ portion on an end surface of an optical memory medium $[(2)]$ at an angle by which a longitudinal direction of the cross section is not parallel with an interface between a core $[(21)]$ and a clad $[(22)]$, the optical memory medium $[(2)]$ comprising cores $[(21)]$ each of which constitutes a planar optical waveguide and clads $[(22)]$ which sandwich each core $[(21)]$ and having a data image $[(203)]$ in which data is recorded as a scattering factor and a pair of positioning marks $[(201, 202)]$ which are respectively scattering factors required for positioning at the interface between the core $[(21)]$ and the clad $[(22)]$ or in the core $[(21)]$, the positioning/read light $[(104)]$ being coupled with the core $[(21)]$ to form an optical coupling area in such a manner that the optical coupling area includes the data image $[(203)]$, the optical memory reproduction apparatus reproducing data based on a data reproduction light $[(1031)]$ generated due to scattering and interference of the positioning/read light in the data image $[(203)]$,

the incidence positioning method comprising:

forming the optical coupling area by coupling the positioning/read light $[(104)]$ which has entered the core $[(21)]$ with the core $[(21)]$ in such a manner that both end portions of the optical coupling area include the pair of positioning marks $[(201, 202)]$; receiving by a positioning mark light receiving element $[(131, 132)]$ a pair of positioning mark lights $[(1011, 1021)]$ generated due to scattering and interference of the positioning/read light $[(104)]$ in the pair of positioning marks $[(201, 202)]$; and controlling an incidence position of the positioning/read light $[(104)]$ emitted from the light source $[(11)]$ with respect to the core $[(21)]$ in a thickness direction thereof based on intensities of the pair of positioning mark lights $[(1011, 1021)]$ which have entered the positioning mark light receiving element $[(131, 132)]$.

16. (Currently Amended) The incidence positioning method according to claim 9, claim 12 or claim 15, wherein the step of controlling a position of the light source $[(11)]$ compares the intensities of the pair of positioning mark lights $[(1011, 1021)]$ with each other, determines a movement direction of the light emitted from the light source $[(11)]$ and moves the light in accordance with a result of the comparison, and controls the incidence position of the light emitted from the light source $[(11)]$ in such a manner that an intensity difference becomes zero.